

REMARKS

This responds to the Office Action mailed on March 29, 2004.

Claims 1, 8, 9, 13, 14, 20, and 21 are amended, no claims are canceled, and no claims are added; as a result, claims 1-36 are now pending in this application. The amendments to the claims are fully supported by the specification as originally filed. No new matter is introduced. The amendments are made to clarify the claims. Applicant respectfully requests reconsideration of the above-identified application in view of the amendments above and the remarks that follow.

Support for the amendments can be found, for example, in original claim 21, and the material incorporated by reference in its entirety from co-pending application 09/144,202, now issued U.S. Patent 6,320,222. Supporting examples from the incorporated material can be found in the amendments to the specification filed in the response, mailed 27 May 2003, to Office Action, mailed 25 February 2003, on page 8, lines 11-17 and on page 15, line 4 – page 17, line 7.

In the Specification

The specification is amended for clarity. The paragraphs in the Summary of the Invention beginning with the paragraph at page 3, line 19 through the paragraph ending at page 5, line 21 are moved to the Detailed Description section and inserted before the paragraph beginning at page 7, line 18. No new matter is introduced.

In the Abstract

The abstract is amended for clarity. It is amended to conform to the amendments to the title. No new matter is introduced.

Objection to the Title

The title was objected to as it includes the term “improved” (MPEP 606). A new title was requested.

The title is amended to delete the term “improved,” and generally reflect elements of a method that are included in claim 1. Applicant respectfully requests the withdrawal of the

objection to the title.

Double Patenting Rejection

Claims 1-36 were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-22 of U.S. Patent No. 6,320,222 taken with Mazure (U.S. 5,308,782).

Applicant does not admit that claims are obvious in view of Patent No. 6,320,222. However, a Terminal Disclaimer in compliance with 37 CFR 1.321(b)(iv) is enclosed herewith to obviate these rejections. Applicant requests removal of these rejections of claims 1-36, and reconsideration and allowance of these claims.

First §103 Rejection of the Claims

Claims 1-26 were rejected under 35 USC § 103(a) as being unpatentable over Mazure et al. (U.S. 5,308,782) taken with Mukai (U.S. 5,804,848) and Colinge (Article of “Reduction of Kind Effect....”). Applicant traverses these grounds of rejection of these claims.

Applicant can not find a teaching or suggestion in the combination of Mazure et al. (hereafter Mazure), Mukai, and Colinge of a method that includes vertically forming a body region such that the body region is formed having a width that is sufficiently thin relative to a doping concentration (NA) of the body region such that a bulk charge (QB) is negligible in transistor operation as recited in claim 1, as amended. The Office Action states “Mazure ... lacks mentioning thickness of the body region as a fully depleted structure,” uses Colinge to disclose a fully depleted structure, and uses Mukai with respect to multiple gate contacts. However, Colinge deals with a thin-film fully depleted structure of a fixed channel doping without defining the structure based on the effects of bulk charge to the transistor operation. The combined references appear to be void of a teaching or suggestion of a method that provides a fully depleted structure by forming a body region to have a width dependent on doping concentration to provide for operation such that bulk charge in the body region has negligible effect on transistor operation. A fully depleted structure provided from combining the cited references does not teach or suggest a method that uses dimensions and concentrations relative to

the effect on a body region's bulk charge on transistor operation. Thus, applicant submits that Mazure taken with Mukai and Colinge does not teach or suggest all the elements of the method as recited in claim 1, and that claim 1 is patentable over Mazure taken with Mukai and Colinge.

Further, with respect to a fully depleted structure, Applicant submits that the combination of Mazure and Colinge does not render the fully depleted structure as recited in claim 1 obvious. Mazure deals with vertically stacking transistors in a memory device. Colinge deals with a horizontal transistor structure having a gate on a gate oxide and a backside gate, not on a gate oxide, but on the back on the substrate on which the horizontal transistor is formed. There is no teaching or suggestion in Colinge regarding a vertical transistor structure having a body region as a fully depleted structure. The Office Action has not provided a reference to support the modification of Colinge and Mazure as proposed in the Office Action.

The Office Action states:

Also it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the transistor body regions of Mazure to have a thickness as taught by Colinge so as to form the thin film transistor comprising a thin body channel region operated as fully depleted structure. This is because of the desirability to reduce the kink effect, current overshoots, and to form a very thin transistor.

As noted in the opening sentences of the first paragraph of Colinge, these desirable effects noted in the above quote, are related to problems whose origins arise from a horizontal silicon-on-insulator n-channel MOSFET and are floating-substrate effects. Mazure addresses problems of planar transistors with vertical transistor structures, where the initial vertical transistor in the structure is fabricated up from the substrate starting with a diffusion region (14) on which a drain region (28) is formed. It appears that Mazure does not need to address floating-substrate effects identified in Colinge. Thus there is no motivation to combine Colinge with Mazure. The fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990); MPEP § 2143.01. Applicant submits that the Office Action has not provided a reference suggesting the desirability of the combination and modification of the cited references, given that Mazure deals with vertical transistor structures and Colinge deals

with a horizontal transistor structure, and the reasons for the combination provided in the Office Action do not appear to apply.

Applicant submits that at least for the reasons stated above claim 1 is patentable over Mazure taken with Mukai and Colinge. Independent claims 8, 9, 13, 14, 20, and 21 recite elements similar to the elements of claim 1 discussed above and are patentable over Mazure taken with Mukai and Colinge for at least the reasons stated above and in further view of the elements of these independent claims. The claims dependent on claims 1, 8, 9, 13, 14, 20, and 21 are patentable over Mazure taken with Mukai and Colinge for at least the reasons stated above and in further view of the elements of these dependent claims.

Applicant respectfully requests withdrawal of these rejections of claims 1-26, and reconsideration and allowance of these claims.

Second §103 Rejection of the Claims

Claims 1-30 were rejected under 35 USC § 103(a) as being unpatentable over Bertin et al. (U.S. 6,060,746) taken with Mukai (U.S. 5,804,848), and Lidow et al. (U.S. 4,680,853). Applicant traverses these grounds of rejection of these claims.

Applicant can not find a teaching or suggestion in the combination of Bertin et al. (hereafter Bertin), Mukai, and Lidow et al. (hereafter Lidow) of a method that includes vertically forming a body region such that the body region is formed having a width that is sufficiently thin relative to a doping concentration (NA) of the body region such that a bulk charge (QB) is negligible in transistor operation as recited in claim 1, as amended. The Office Action states “Bertin et al. teach a method ... vertically forming a body region 19 on the first source/drain region 23,12 (Figs 6,7) as a fully depleted structure (col 2, lines 17-21).” Bertin at column 2, lines 17-21 recites “the very narrow diameter pillar makes fully depleted operation possible. Fully depleted operation mode is desirable as it provides enhanced gate control (i.e. near ideal sub- V_t slope) and allows operation at even shorter channels.” Bertin appears to be void of a teaching or suggestion of a method that provides a fully depleted structure by forming a body region to have a width dependent on doping concentration to provide for operation such that bulk charge in the body region has negligible effect on transistor operation. The Office Action

applies Mukai and Lidow with respect to a plurality of gate electrodes and a plurality of contacts to a common gate. Therefore, Mukai and Lidow do not cure the deficiencies of applying Bertin to the elements of amended claim 1. A fully depleted structure provided from combining the cited references does not teach or suggest a method that uses dimensions and concentrations relative to the effect on a body region's bulk charge on transistor. Thus, applicant submits that Bertin taken with Mukai and Lidow does not teach or suggest all the elements of the method as recited in claim 1, and that at least for the reasons stated above claim 1 is patentable over Bertin taken with Mukai and Lidow.

Independent claims 8, 9, 13, 14, 20, and 21 recite elements similar to the elements of claim 1 discussed above and are patentable over Bertin taken with Mukai and Lidow for at least the reasons stated above and in further view of the elements of these independent claims. The claims dependent on claims 1, 8, 9, 13, 14, 20, and 21 are patentable over Bertin taken with Mukai and Lidow for at least the reasons stated above and in further view of the elements of these dependent claims.

Applicant respectfully requests withdrawal of these rejections of claims 1-30, and reconsideration and allowance of these claims.

Third §103 Rejection of the Claims

Claims 31-36 were rejected under 35 USC § 103(a) as being unpatentable over Bertin et al. (U.S. 6,060,746) taken with Mukai (U.S. 5,804,848), and Lidow et al. (U.S. 4,680,853) as applied to claims 1-30 and further Mazure et al. (U.S. 5,308,782). Applicant traverses these grounds of rejection of these claims.

Claims 31-36 are dependent on claims 1, 8, 9, 13, 20, and 21, respectively, and are patentable over Bertin taken with Mukai and Lidow as applied to claims 1-30 and in further in view of Mazure for at least the reasons stated above with respect to claims 1-30 and in further view of the elements of these independent claims.

Applicant respectfully requests withdrawal of these rejections of claims 31-36, and reconsideration and allowance of these claims.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney (612) 371-2157 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

LEONARD FORBES ET AL.

By their Representatives,

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.


P.O. Box 2938

Minneapolis, MN 55402

(612) 371-2157

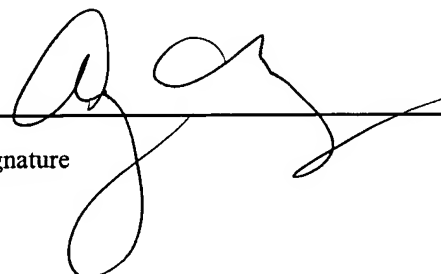
Date 28 May 2004

By


David R. Cochran
Reg. No. 46,632

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Mail Stop AF, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 28th day of May, 2004.

Amy Morarty
Name


Signature